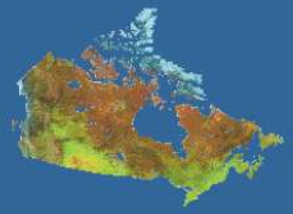


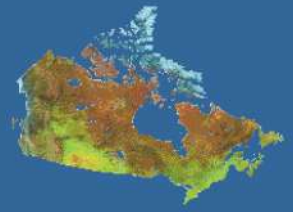
Update on Canada's Medical Isotope Activities

2013 Topical Meeting on Molybdenum-99 (Mo-99) Technological Development

April 3, 2013

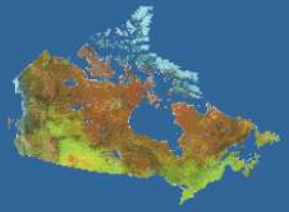
Karen Huynh
Natural Resources Canada

Purpose



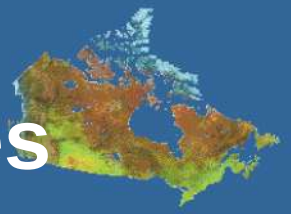
To provide an overview of the Government of Canada's policies and programs for securing supply of technetium-99m (Tc-99m) for Canadians

Canada's isotope strategy has been constant since 2010



- Committed to increasing the security of isotope supply in Canada in the long term
- Investing in maintaining safe and reliable isotope production by the National Research Universal (NRU) reactor until 2016
- Investing in non-reactor-based production to:
  - Diversify sources of isotope supply
  - Create a truly commercial market
  - Reduce radioactive waste produced
  - Eliminate the use of Highly Enriched Uranium (HEU)
- Working with the international community to better coordinate outages and production of medical isotopes

Long-term strategy centres on non-reactor-based technologies



- In 2010, the Government announced its intention to cease production of Mo-99 from the NRU by 2016
  - Move away from government involvement in isotope production

- From 2010 to 2012, Canada invested $35 million in the Non-reactor-based Isotope Supply Contribution Program (NISP)
  - Supported the development of production of Mo-99/Tc-99m using cyclotrons and linear accelerators
    - TRIUMF (cyclotron)
    - Advanced Cyclotron Systems Inc. (ACSI) (cyclotron)
    - Canadian Light Source Inc. (CLSI) (linear accelerator)
    - Prairie Isotope Production Enterprise (PIPE) (linear accelerator)

NISP Project: TRIUMF - Cyclotron

- **Principal Investigators: Dr. Paul Schaffer and Dr. Thomas Ruth**
- TRIUMF and its partners, the BC Cancer Agency, Lawson Health Research Institute and the Centre for Probe Development and Commercialization (CPDC) have combined their expertise to established Tc-99m production on three different types of cyclotrons in Canada.

NISP Project: Advance Cyclotron Systems Inc. - Cyclotron

- **Principal Investigator: Dr. Alexander Zyuzin**
- ACSI and its partners, Hospitalier Universitaire de Sherbrooke / Sherbrooke Molecular Imaging Centre (CHUS/CIMS) and the Edmonton Radiopharmaceutical Center (ERC) at the University of Alberta, have demonstrated the direct production of Tc-99m on ACSI's TR-24, 24 MeV cyclotrons through the establishment of two pilot sites.

ACSI, in Richmond, British Columbia

CHUS/CIMS in Sherbrooke, Quebec

ERC in Edmonton, Alberta

NISP Project: Canadian Light Source Inc.– Linear Accelerator

- **Principal Investigator: Dr. Mark de Jong**

- CLSI has constructed a pilot production facility at CLSI for a high-power linear accelerator-based production of Tc-99m via the transmutation of molybdenum-100 (Mo-100).The project has demonstrated that suitable Mo-99 and Tc-99m can be produced.

Dr. Mark de Jong at the CLSI facility

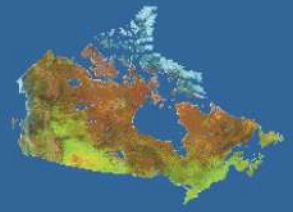
NISP Project: Prairie Isotope Production Inc. – Linear Accelerator

- **Principal Investigator:**
  Dr. Kennedy Mang'era and Chris Saunders

- PIPE, comprised of the University of Winnipeg, the Winnipeg Regional Health Authority (WRHA) and Acsion Industries Inc., with a focus on target and converter optimization has demonstrated the feasibility of linear accelerator-based production of Tc-99m via the transmutation of molybdenum-100 (Mo-100).

PIPE team at the Health Science Center, WHRA : (right to left) Dana Erickson, Dr. John Wilkins, Brock Wright, Kennedy Mang'era, James Currie, John Barnard and David Walker

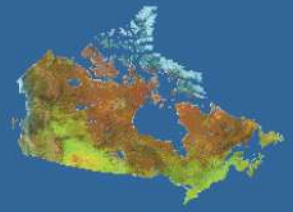
NISP achieved its objectives



- The NISP, which funding ended March 31, 2012, has met its objectives:
  - Provided the funds for infrastructure and equipment upgrades
  - Establishing the technical potential of these technologies

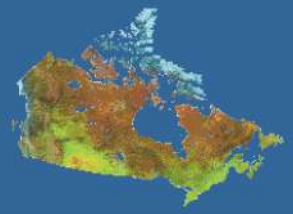
- Projects have demonstrated:
  - Efficient radiochemical separation of Tc-99m has been achieved
  - Progress on Mo-100 recycling
  - Progress on target development
  - Demonstrated Tc-99m production
  - Radionuclidic purity of Tc-99m measured and understood
  - Animal studies and first human trials underway

However, more work is required



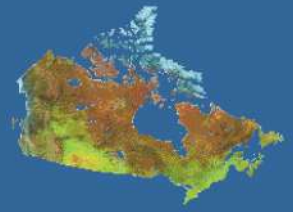
- Optimization of product yield (balance of quantity vs. quality)
- Increasing efficiency of separations
- Pre-clinical and clinical validation
- Meeting regulatory requirements

Isotope Technology Acceleration Program



- Canada has launched a conditionally repayable program – the Isotope Technology Acceleration Program (ITAP) – an investment of $25 million over four years (2012-2016)
  - To further advance cyclotron and linear accelerator technologies for the production of Tc-99m
- The ITAP is designed to leverage and build on the progress made to date under the NISP
- In February 2013, the Government announced the signing of contribution agreements
  - University of Alberta ($7 million - cyclotron)
  - TRIUMF ($7 million – cyclotron)
  - Prairie Isotope Production Enterprise ($7.46 million – linear accelerator)

Going Forward



- 2013 – 2016: Advancement of non-reactor-based technologies
- 2016 – NRU expected to cease production of Mo-99